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Of the Nature and Dietetic Use of Water.

WATER-DRINKERS imagine that they are drinking a perfectly pure element; but the enquiries and experiments of natural philosophers have demonstrated, that every drop of water is a world in miniature, in which all the four elements and all the three kingdoms of Nature are combined. Woodward, who took particular pains to examine our English waters, found none of them free from extraneous matters. Boerhaave called the water which the clouds send down to us the ley of the atmosphere, because it is intermixed with so many foreign matters which it envelopes in its descent through the air: nay the very water that has been purified by art still contains a large proportion of such matters. Distill, or filter water as often as you please, and it will nevertheless in time turn putrid in the sun, and by its bubbles, scum, sediment, and taste, afford evidence of its impurity.

Let not the reader suppose that I deal in exaggeration, when I term every drop of water a world in miniature, a compound of all the four elements, and all the three kingdoms of Nature: for I can prove the accuracy of this definition in every point.

Besides water itself, as the primary element, all water contains a variety of earthy particles. Pure water, when distilled, yields an earth; and Boyle found, that after it had been distilled two hundred times, it still contained this kind of matter. We know from experiments, that a tea-spoonful of water, ground in the cleanest glass mortar, becomes turbid in a few minutes, and in half an hour quite thick, and as it were a solid body. Pott conjectured that this earth proceeded from the friction of the glass, because he found that it was vitrified by a high degree of heat: this notion, however, is refuted by Eller; and not only did Wallerius find the earth of water ground in mortars of iron or other metals of precisely the same nature as that from glass-mortars; but the presence of earth in water may be proved by other experiments, to which this objection of the friction of the glass will not apply. A few drops of oil of tartar dropped into water, will instantly detect its earthy particles. Woodward says, that we need only let water stand a few days in a clean closely-covered glass, and abundance of earthy particles will not fail to appear. If we, moreover, consider how much earthy matter water every where meets with in the air and in the ground, which it partly takes up and carries away with it, and partly dissolves, we cannot for a moment doubt its presence in water. In the ancient Roman aqueducts were deposited thick incrustations of tuff-stone or marble-dust, which in time became quite solid: and I shrewdly suspect that there are very few tea-kettles in constant use in our immense metropolis, but exhibit the same phenomenon. In short, all rain, river, and spring-water, if left to stand any time, deposits an earthy sediment.

Among the earthy matters in water, I include every thing that belongs to the mineral kingdom: a calcareous earth, a selenitic matter, nay even real iron are found in it. Water contains also several species of salts. In rain and snow-water we discover an acid, arising from common salt and nitre. Pliny, of old, regarded snow-water as more

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fertilizing than any other on account of its salts; and for the same reason Bartholin ascribed to it certain medicinal qualities. It is also owing to the presence of particular salts that washerwomen find rain and snow-water fitter for their purpose than spring-water; and as it has been ascertained that water, like all salts, crystallizes under a certain invariable angle, since the icy particles always form under an angle of sixty degrees, we might almost be tempted to consider water in general as a species of salt, if the other properties of the salts did but coincide with this. In spring-water we find real sea-salt and nitre: and it is a remarkable fact, that water can absorb all these salts without occupying on that account a greater space. The warmer water is, the more salt it is capable of holding in solution; boiling water will dissolve nearly its own weight of salt; while freezing water, on the contrary, deposits ever so small a portion of salt that it may have taken up.

This, however, is not all. Water contains also inflammable or sulphureous particles, which manifest themselves in its sediment, in its putrefaction, and in many chemical experiments which are recorded by the best writers. It must not be imagined that I here allude to the mineral waters only, some of which actually take fire. Common putrid water frequently inflames in the ame smanner; and moreover, the existence of caloric, or fiery particles, in water, cannot be doubted; for without them it would not be a fluid but a solid body. As soon as water is deprived of all its caloric, it contracts, becomes more ponderous, and acquires the solidity of stone. Muschenbroeck and Eller found that heat expands water about a twenty-fourth or twenty-sixth part; and that in passing from the freezing point to the degree of heat at which it begins to boil, it becomes about a sixty-fifth part lighter. As then it is the caloric or fiery particles alone which keep the particles of water so slightly connected that they form a fluid body; the presence of caloric in all water must be incontestable. On this account Boerhaave called water a sort of glass, which melts at the thirty-third degree of heat, and the vapours of which are wholly composed of small glass globules.

That water contains air, is a point which no one will dispute. It has been observed that this air is expelled from the intervals between its particles, at a heat of 150 degrees of Fahrenheit's thermometer; but that it does not begin to boil under 212 degrees. As water, deprived of its air, occupies no smaller space than before, the air, like the dissolved salts, cannot take up any perceptible space in water, but must insinuate itself into the minutest interstices. Hence probably it is, that the intermixture of air with water takes place so slowly; for if water that has been deprived of all its air, is exposed to the atmosphere, it takes several days, and even weeks, before the air again combines with it: and to this end no shaking or agitation is required. This has been fully demonstrated by the most careful experiments of many eminent natural philosophers, as Mariotte, Boerhaave, Muschenbroeck, Nollet, and Hamberger; and Eller has calculated that the natural proportion of air contained by common water, amounts to a hundred-and-fiftieth part.

As then common water comprehends earth, salts, caloric, and air, it is evident that all the four elements are combined in every drop. But, methinks, I hear the inquisitive reader exclaim, how do you make out the three kingdoms of Nature?

The mineral kingdom I have already introduced. Earth, lime, chalk, selenitic matter, sea-salt, nitre, inflammable matters, caloric, iron, are all associated in a drop of water. We now want nothing but vegetable and animal matter.

All water must contain a vegetable principle, because all vegetables are solely and alone generated and nourished by it. That the earth contributes nothing to this effect, is almost incontestable. Many natural philosophers have found by accurate experiments, that a vessel full of mould, after a large tree has grown in it, loses none of its original weight; and hence it follows, that the water used in watering it, must have exclusively operated the developement, growth, and nourishment of the tree. This observation is very old, and has merely been confirmed by the moderns. As then it is inferred, that the earth contributes nothing to the principle of vegetables, philosophers have also proved that water, considered *per se*, is not transformed into the substances of plants, or converted into a solid body, but that it is only the vehicle of the vegetable particles, and merely conveys them to the plants. Woodward, who thoroughly investigated this subject, has demonstrated that water itself, nourishes plants no more than earth, but that it is only the vehicle of the vegetable matter; and it is in this way that we must understand the principles of the philosophers, of Thales, Seneca, Cicero, Van Helmont, and others, when they regard water as the primary element of all things, or assert with Palissy, that without water nothing can say—I exist. As then water is capable of communicating to all vegetables that by which they become what they are, it must be considered as the parent of the whole vegetable kingdom, and every drop of it must comprehend the elements of thousands of different plants.

The animal kingdom alone now remains: and this, too, inhabits the water. I shall say nothing of the fish, and the large aquatic insects that dwell in it by millions; for the very smallest drops of water have their inhabitants, which may be discovered with suitable optical instruments. Every body knows also how soon animalculæ are generated in stagnant water. In long voyages, the water on board ships becomes putrid, perhaps three or four times, and then contains innumerable small worms, which, when they have accomplished the period of their existence, die, and then the water again becomes drinkable. Soon afterwards, other species of similar animalculæ are generated, and the water again becomes foul. If we would preserve it from this impurity, or destroy the worms which infest it, we must have recourse to the assistance of art; and either burn sulphur in the vessels before they are filled, or drop into the water a few drops of vitriolic acid, which kills the animalculæ. There are good grounds for suspecting that the generation of these worms in water is chiefly owing to heat, and to the influence of air; for it is remarked in ships, that those butts which are placed in the warmest situations, generate worms the soonest; and that water, which is inaccessible to air, keeps perfectly sweet for many years. Clavius kept water sweet for twenty years in a retort, the neck of which was closed up by its accidental melting, without perceiving the smallest diminution. In the subterraneous city of Herculaneum, water was found after the lapse of nearly as many centuries in strong crystal vases. The water of the Rhone is kept at Arles eighty years in earthen vessels placed in cool cellars. These observations, however, prove nothing more than that the developement of the spawn of worms in water may be prevented by external circumstances, by cold and by the exclusion of the air. The principle of these worms, the elementary matter of them, which belongs to the animal kingdom, nevertheless indisputably exists, though in a dormant state, in the water.

From all this it is evident how egregiously they are mistaken, who imagine that in water they are drinking a perfectly pure element. It is true, that if water were perfectly pure, it would be one of the finest beverages, and its indissoluble elementary parts would produce scarcely any medicinal effect on the human body. But when we consider in what manner water nourishes plants, we may easily infer, that in animals also it is not transformed into the rudiments of their bodies, but rather communicates to them the few nutritious organic particles which it contains. Hence it is that water, if pure, possesses no particular nutritious property; but, by means of its peculiar subtilty, it dissolves the nutritious parts of the alimentary substances, and conveys them into the minutest vessels. Of this subtilty of water some notion may be formed, when it is known, that a drop of water, when converted into vapour, occupies, according to Eller's calculation, a space 13,000 times greater than before; and that, as Leuwenhoeck found, the pores of the skin, by which water, in the form of vapour, is secreted in perspiration from the blood, are 24,000 times smaller than a grain of sand. By means of this astonishing subtilty, water can convey the alimentary particles, which it absorbs to the remotest points of the body; and so far it produces an incomparable effect in diet. We observe this effect in beer, which is nothing but water saturated with animal nutriment. At the same time, it is obvious how necessary it is to mix our solid food with a sufficient quantity of liquid in the stomach, that it may be subtilized by this solvent, and carried along with it into all quarters. In this point of view I regard water, with Pindar, as the most useful thing in life, because it is the vehicle that conveys our nutriment to its proper place; but of itself I do not imagine that it contributes in the least to the nourishment of the body, since it is not at all probable that it should change into a solid body, or that its pure particles should dissolve.

I consider water as an inestimable benefit to health, not as water, but inasmuch as it is a fluid. Without fluids we should not be able to digest any thing, and with a superabundance of the most nutritious, but perfectly solid food, we should dry up and inevitably perish. Fluids dissolve our food, and the water saturated with the liquefied animal particles of food is the chyle, which insinuates itself with this vehicle into the most secret channels and minutest interstices of all our parts. Here this viscous nutriment combines with the solid parts of our bodies, and the remaining water, leaving its companion behind, pursues its course into the most delicate vessels, till it arrives beneath the epidermis, where the air imbibes it, as it were, from the skin in the form of an infinitely subtile vapour, and gives it back to the world at large, as it does also in the case of plants. In this manner water promotes perspiration and urine.

I have already observed that water also absorbs salts, and even contains something oleaginous in its composition. Hence it is easy to conceive, how the water that mingles with our juices, imbibes a superabundance of acridity which exists in them, and laden with this fresh burden, must be voided from the body to return to its general home. The sweetest water, which passes off again in urine in the space of a few minutes, with scarcely any change of colour, nevertheless betrays, both in taste and smell, traces of salt and animal oil, and the perspiration carries with it a large proportion of both. Hence water is a good beverage for those who eat much salt meat, or who have upon the whole a superabundance of sharp humours. It is better for them than beer or any other liquid that is already saturated with extraneous particles of a different nature, and herein consists the chief pre-eminence of pure water over other beverages.

A liquid, already saturated with particles of any kind which it is capable of dissolving, will not take up so large a proportion of particles of a different kind, as it would otherwise do. Eight ounces of water, in which nine ounces and a half of green vitriol have been dissolved, will be completely saturated with it: the water will nevertheless be still capable of taking up one ounce and a half of Epsom salt, two drams of refined saltpetre, and three ounces of refined sugar. But if the water is not previously saturated with vitriol, it can hold in solution five ounces and a half of Epsom salt, four ounces of pure nitre, &c. Any water, therefore, which is already saturated with particles of a certain kind, is not so well adapted to the purification of our juices from insoluble impurities as that which is not so impregnated; consequently, no beer, no broth, no wine, and perhaps, too, no decoction for cleansing the blood, is so efficacious for this purpose as the very purest water.

As water can perform such great things, and at the same time, because it has no taste, it neither stimulates the appetite to excess, nor can produce any perceptible effect on the nerves, it is admirably adapted for diet, and we ought, perhaps, by right, to make it our sole beverage, as it was with the first of mankind, and still is with all the animals. Pure water dissolves the food more, and more readily, than that which is saturated, and likewise absorbs better the acrimony from the juices—that is to say, it is more nutritious and preserves the juices in their natural purity; it penetrates more easily through the smallest vessels, and removes obstructions in them; nay, when taken in large quantity, it is a very potent antidote to poison.

From these main properties of water may be deduced all the surprising cures which have been effected by it in so many diseases, and which I shall here pass over altogether. But as to the dietetic effect of water, I shall recommend it to my readers for their ordinary beverage on three conditions.

The first is, that they drink it as pure as possible. Impure water is of itself impregnated with foreign matters which may prove prejudicial to health. Hence it loses all the advantages which I have in the preceding pages ascribed to water; and it would in this case be much better to drink beer or any other such beverage that is saturated with nutritive particles rather than impure water. We must leave the stomachs of camels to answer for the preference given by them to muddy water; for we are assured by Shaw, that these animals stir it up with their feet and render it turbid before they drink. The human economy requires, on the contrary, a pure beverage.

The signs of good water are, that it easily becomes hot and cold; that in summer it is cool, and in winter slightly lukewarm; that a drop dried on a clean cloth leaves not the faintest stain behind; and that it has neither taste nor smell. It is also a sign of good water that when it is boiled it becomes hot, and afterwards grows cold, sooner than other water. But this sign is far more fallible than the evidence of the quality of water obtained by feeling. Singular as this may sound, it is very possible to distinguish the properties of water by means of this sense. A soft or a hard water is synonymous with a water the parts of which adhere slightly or closely together. The slighter their adhesion, the less they resist the feeling, and the less sensible they are to the hand, because they may be so much the more easily separated. A gentleman of my acquaintance has for many years used two different sorts of water, which are equally pure and limpid, the one for drinking and the other for washing his hands and face. If his servant ever happens to bring the wrong water for washing, he instantly discovers the mistake by the feeling. Our cooks and washerwomen would be able to furnish many other instances of the faculty of discriminating the properties of water by the touch, which would show that this faculty depends more on the excitement occasioned in the sensible parts than on any other cause. Hard water, for instance, makes the skin rough; soft, on the contrary, renders it smooth. The former cannot sufficiently soften flesh or vegetables; the latter readily produces this effect. The difference of the extraneous matters which change the qualities of water, naturally makes a different impression on the feeling; and in this there is nothing that ought to astonish a person of reflection.

The water of standing pools and wells is in general extremely impure, and is accounted the worst of all. River water differs according to the variety of the soil over which it runs, and the changes of the weather; but though commonly drunk, it is never pure. Of all impure river waters, those which abound in earthy particles alone are the least injurious, because those particles are not dissolved by the water. In Auvergne, near the villages of St. Allire and Clermont, there is a stream of a petrifying quality, which constructs of itself large bridges of stone, and yet it is the only water drunk by the inhabitants of those places, and that without the slightest inconvenience. If we consider that a stony concretion is deposited in all our kettles, we shall readily conceive, that a water which carries stone along with it cannot be very pernicious to health, since it is constantly drunk by men and animals. This stone in our kettles is really a calcareous earth, which may be dissolved by boiling in them vinegar, or water mixed with a small quantity of nitric acid; and as the water deposits it, and does not hold it in solution, it can of course do us very little injury. I cannot, therefore, imagine how the celebrated Dr. Mead could believe that water which leaves such a deposit in culinary vessels may occasion stone in the kidneys or bladder, merely because Pliny has said so; though he was well acquainted with the great difference between animal calculi and mere calcareous earth.

Next to well and river-water, both which are always impure, rain-water follows in the scale of preference. It is very impure, and a real vehicle for all the pernicious matters that are continually floating in the atmosphere. Snow-water is much purer. Snow is formed of vapours which have been frozen before they could collect into drops. It is in the lower region of the air that these drops in falling absorb most of their impurities. The vapours floating in the upper atmosphere freeze before they reach the mire of the lower. This water is seldom to be had. That which I would most strongly recommend for drinking, is a spring-water, which descends from lofty hills, through flints and pure sand, and rolls gently along over a similar bed or rocks. Such water leaves behind all its coarse impurities in the sand; it is a purified rain and snow-water, a fluid crystal, a real cordial, and the best beverage for persons in good health.

The second condition which I attach to water-drinking is, that such persons only choose it for their constant beverage, to whom warming, strengthening and nutritive liquids are hurtful; and that if they have not been in the habit of drinking it from their youth, they use some caution in accustoming themselves to it. Many suffer themselves to be led away by the panegyrists of water, without considering that even good changes in the system of life, when a person is not accustomed to them, and when they are abruptly or unseasonably adopted, may be productive of great mischief. Hence arise the silly complaints that water-drinking is dangerous, pernicious, nay fatal, and the inapplicable cases quoted from experience. Those who have been in the habit of drinking water from their youth, cannot choose a more wholesome beverage, if the water be but pure. Many nations, and many thousand more species of animals, have lived well upon it. But for an old infirm person, a living skeleton, with a weak stomach that can scarcely bear solid food, to exchange nourishing beer or strengthening wine, with the water of his brook, would be the height of absurdity. Let such adhere to their accustomed drink. Water is an excellent beverage, but beer too is good; it is also water, more nutritious than the pure element, and therefore more suitable for the persons to whom I am alluding.

The third condition which I require of my water-drinkers is—that they take cold and not hot water for their habitual beverage. I mean not to prohibit their boiling or distilling it if they suspect it to be impure. Boyle drank nothing but such distilled water, and most delicate people of good taste in Italy still do the same. It must not, however, be drunk warm, but cold. The ancients, it is true, drank hot water. Various passages in Plautus and other ancient writers clearly prove that so early as their times it was customary to drink the water of warm springs; and there are frequent instances of common water warmed. Thus, in Dio, we find Drusus, the son of Tiberius, commanding warm water to be given to the people, who asked for water to quench their thirst at a fire which had broken out. Seneca says (*De Ira*, ii, 15,) that a man ought not to fly into a passion with his servant, if he should not bring his water for drinking so quickly as he could wish; or if it should not be hot enough, but only lukewarm; and Arrian says the same thing, but more circumstantially. The drinking of hot water must of course have been a common practice with the Greeks and Romans; but it should be observed, that even in their times it was held to be an effeminate indulgence of voluptuaries. Stratonicus calls the Rhodians "pampered voluptuaries who drink warm liquors." Claudius, when he attempted to improve the morals of the people and to check luxury at Rome, prohibited the public sale of hot water. When on the death of the sister of the Emperor Caius, he had enjoined mourning in the city of Rome on account of this, to him, exceedingly painful loss, he put to death a man who had sold hot water, for this very reason, because he had thereby given occasion for voluptuousness, and profaned the mourning. So dangerous an indulgence was the drinking of hot water considered, that the trade of water-sellers was interdicted by the Censors. Some writers publicly satirized this species of voluptuousness. Ammianus complains that in his time servants were not punished for great vices and misdemeanours, but that three hundred stripes were given them, if they brought the warm beverage either not promptly enough or not hot enough: and from that passage of Martial's in which he says, that at entertainments the host was accustomed to pay particular attention that during the feast there should be an abundant supply of hot water, it appears that this beverage was an essential requisite at the tables of the luxurious.

STANZAS.

In glowing youth, he stood beside
His native stream, and saw it glide
Shewing each gem beneath its tide,
Calm as though nought could break its rest,
Reflecting heaven in its breast,
And seeming, in its flow, to be
Like candour, peace, and piety.

When life began its brilliant dream,
His heart was like his native stream:
The wave-shrined gems could scarcely seem
Less hidden than each wish it knew;
Its life flow'd on as calmly too;
And Heaven shielded it from sin,
To see itself reflected in.

He stood beside that stream again,
When years had fled in strife and pain;
He look'd for its calm course in vain—
For storms profaned its peaceful flow,
And clouds o'erhung its crystal brow:—
And turning then, he sigh'd to deem
His heart still like his native stream.

C. L.